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Using TSP to Improve Performance

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Standard Form 298 (Rev. 8-98)
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Dan Burton has been with the Software Engineering Institute (SEI) since 1991. He has been working on the Personal Software Process (PSP) and Team Software Process (TSP) initiatives, teaching and introducing the PSP and TSP into organizations since 1996.

Before joining the SEI, he worked for Tartan, Inc., a small Ada compiler developer, where he managed the development of the first Ada compiler for a digital signal processor (DSP).

He holds a Master of Science in electrical engineering from the US Air Force Institute of Technology, and a Bachelor of Science in electrical engineering from Carnegie Mellon University.
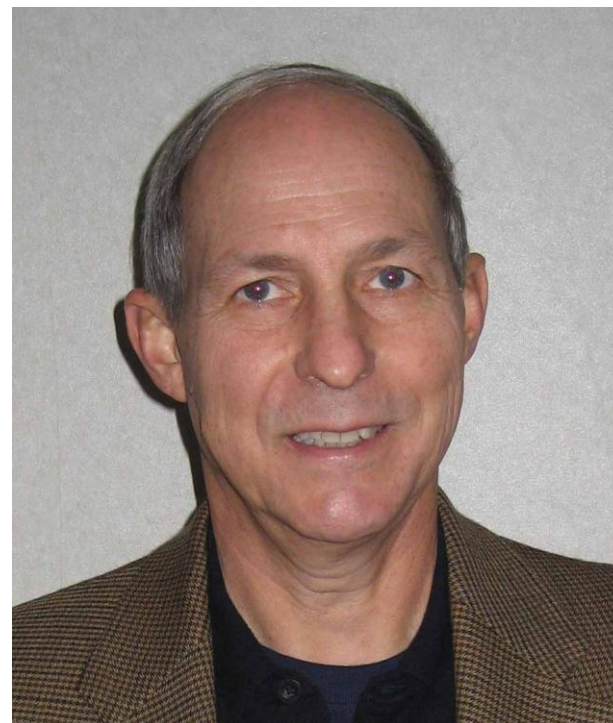
Topics

How does TSP work?

TSP Data

TSP and CMMI

TSP Results

How does TSP work?

TSP achieves performance through

- Personal Software Process (PSP)

- Integrated measurement framework

- Comprehensive quality management

- Self-directed teams

- Coaching
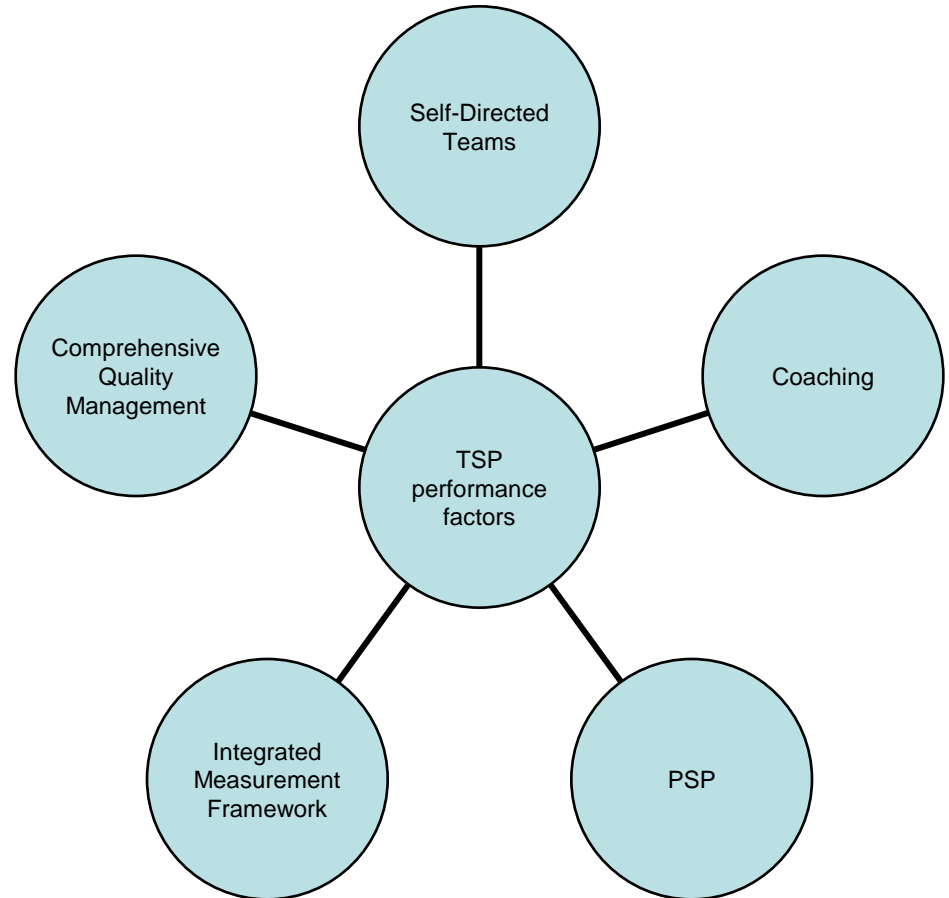
Personal Software Process

The PSP is a process designed for individual use that applies to structured personal tasks.

PSP builds the team member skills required for the TSP.

With PSP, developers learn to follow a defined process and how to measure, estimate, plan, and track their work.

This leads to

- *better estimating, planning, and tracking*

- *protection against over-commitment*

- *a personal commitment to quality*

- *personal involvement in process improvement*

Integrated Measurement Framework

TSP uses a powerful, flexible set of measures (most of which are introduced in PSP) that provides the framework for

- instrumenting existing processes

- project management

- team process evaluation and improvement

- personal process evaluation and improvement

The TSP measurement framework is, as far as we know, unique.

Comprehensive Quality Management

Quality management on TSP teams begins before the project starts, in PSP training.

Individuals are responsible for the quality of their components.

The team is responsible for the quality of its deliverables.

Quality is always quantified using the integrated measurement framework.

Self-Directed Teams

TSP implements the concept of self-directed teams.

- The team builds its own plans, negotiating trade-offs with management.

- The team is committed, collectively and individually, to the plan because it is their own.

- Team members assume many well-defined responsibilities that a team leader would otherwise normally handle.

The self-directed team does *not* replace or obsolete the team leader.

The team leader is still responsible

- to management, for communicating progress and issues, and for results.

- to the team, for communicating management issues, and for support.

- for dealing with the unexpected.

Coaching

World-class athletes and musicians (and the teams and orchestras that they play with) all benefit from professional coaching.

The TSP team leader functions, in many respects, more like a coach than a traditional manager.

However, the role of TSP Coach is usually assumed by someone other than the team leader.

- TSP launches and relaunches

- TSP checkpoints

- fine points of exercising team roles

- help with applying PSP and TSP principles in unusual situations

To achieve full potential, a coach is needed.

Principles

The following principles shaped the design of TSP

- Engineering is a team activity; self-directed teams do the best work.

- Operational processes provide the foundation for planning, tracking, control, and improvement.

- Processes must be measured to be managed and improved.

- The cornerstone of a high-quality process is early defect removal and the cornerstone of a satisfying product is early customer involvement.

- Quality without numbers is just talk.

- Improving project performance will improve organizational performance; improving individual performance will improve project performance.

Building High-Performance Teams

Team Management
Team communication
Team coordination
Project tracking
Risk analysis

Team Building
Goal setting
Role assignment
Tailored team process
Detailed balanced plans

Team Member Skills
Process discipline
Performance measures
Estimating & planning skills
Quality management skills

Team Software Process

Personal Software Process
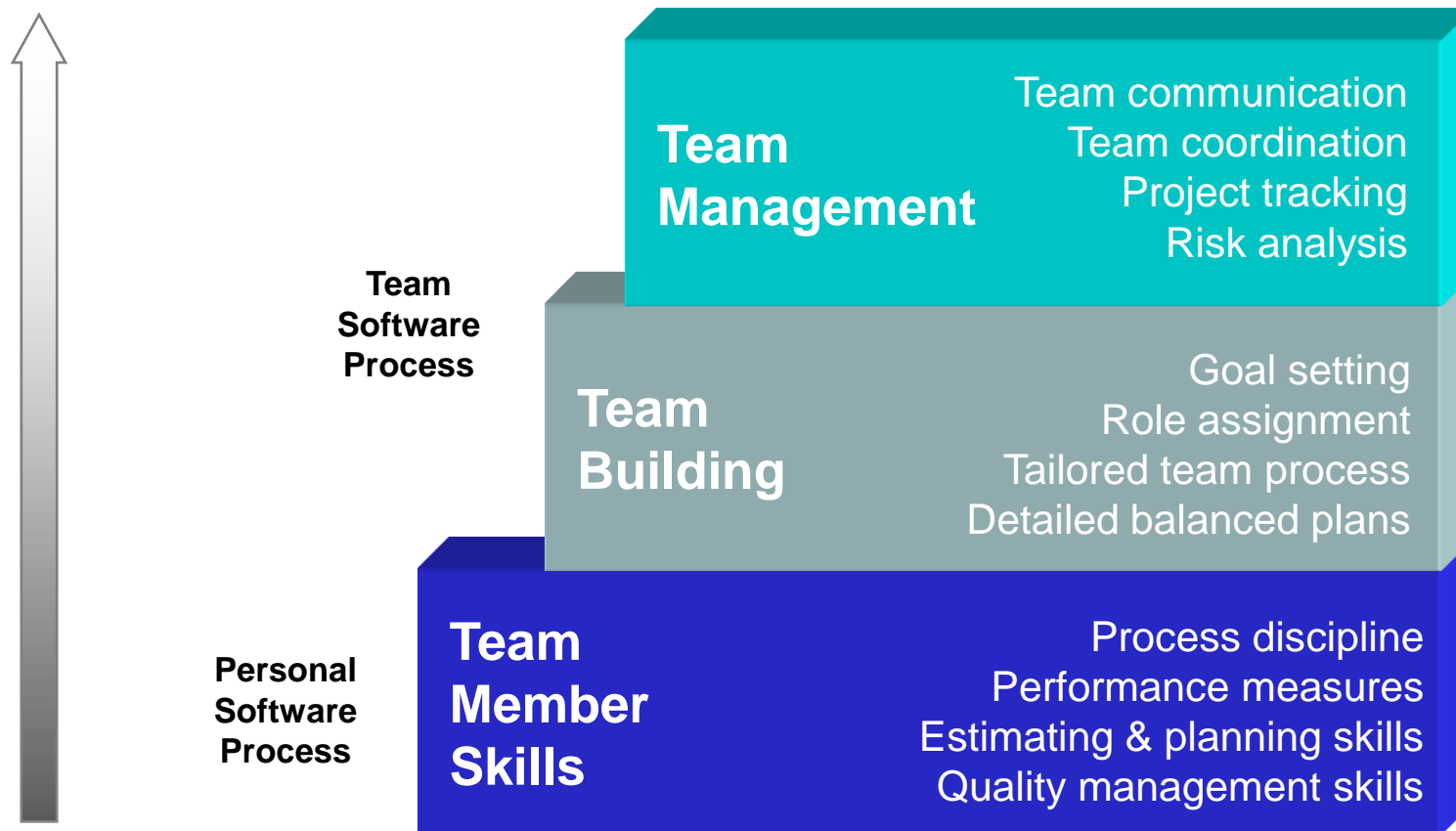
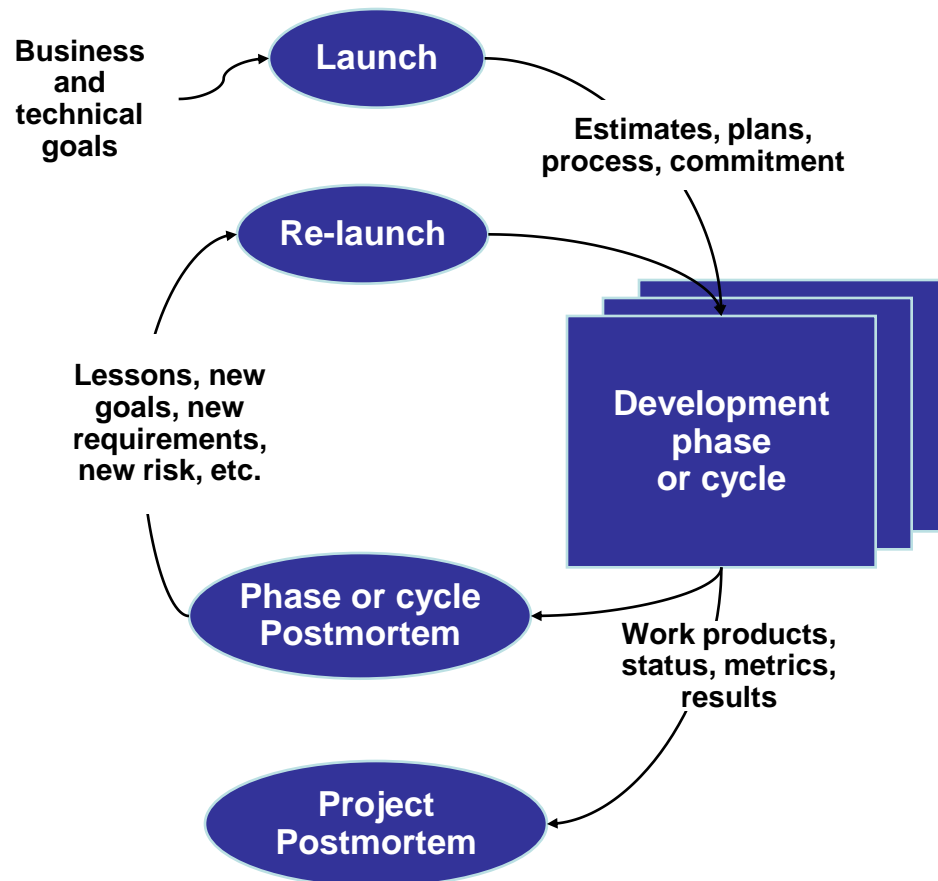*TSP builds high-performance teams from the bottom-up*
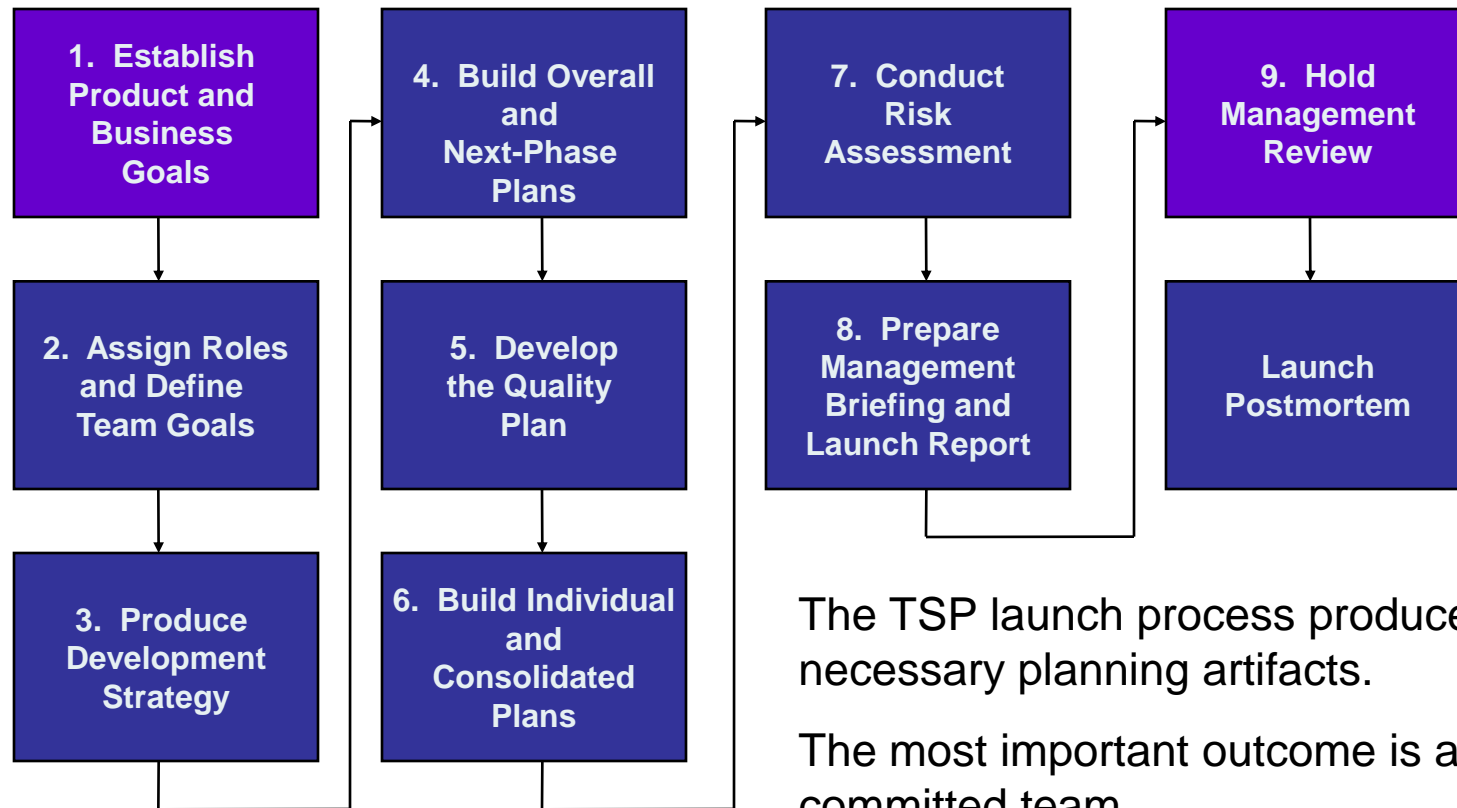
The TSP Planning Process

TSP includes a structured systematic process for planning, the TSP Launch.

Each project cycle starts with a TSP Launch or Re-launch to plan the next cycle and the rest of the project.

Each project cycle ends with a postmortem that provides qualitative and quantitative feedback to guide the remainder of the project.

The TSP Launch Process

| 1. Establish Product and Business Goals | 4. Build Overall and Next-Phase Plans | 7. Conduct Risk Assessment | 9. Hold Management Review |

| 2. Assign Roles and Define Team Goals | 5. Develop the Quality Plan | 8. Prepare Management Briefing and Launch Report | Launch Postmortem |

| 3. Produce Development Strategy | 6. Build Individual and Consolidated Plans |

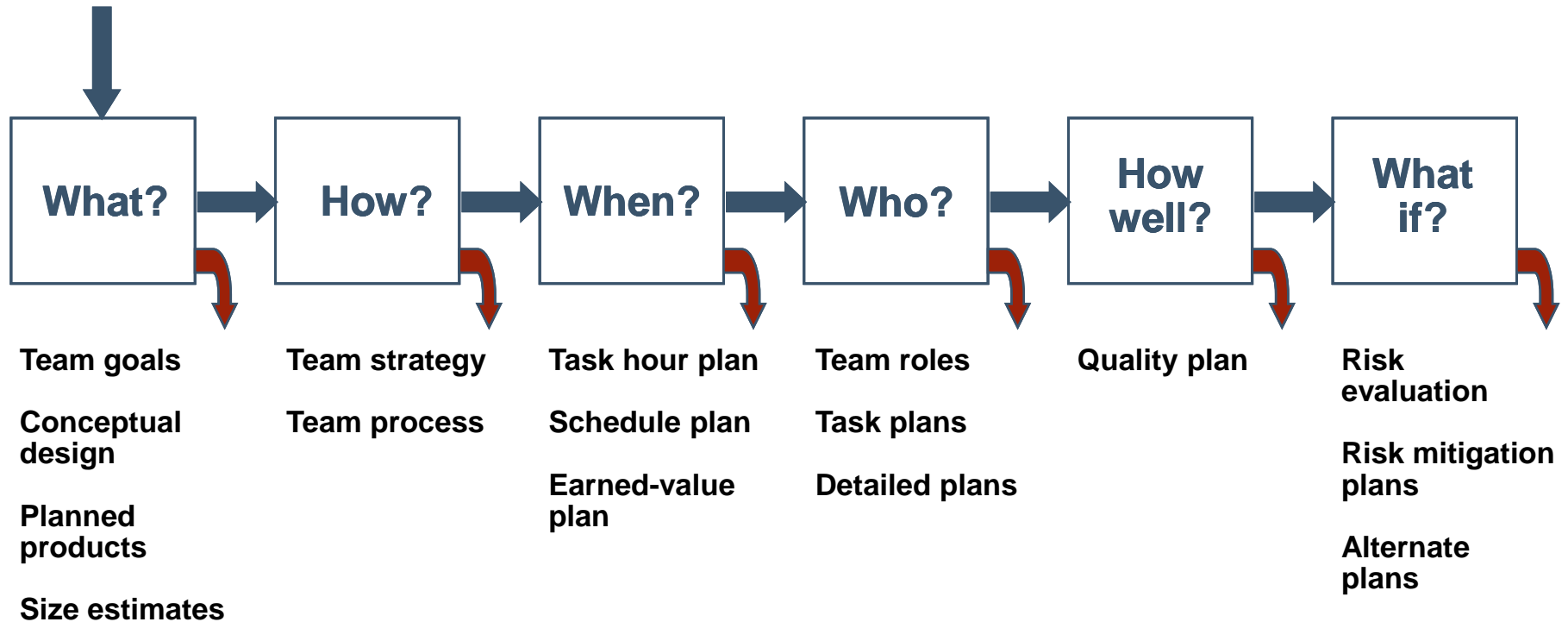The TSP launch process produces necessary planning artifacts.

The most important outcome is a committed team.

The TSP Launch Products

Business needs

Management goals

Product requirements

What?	How?	When?	Who?	How well?	What if?

Team goals

Conceptual design

Planned products

Size estimates

Team strategy

Team process

Task hour plan

Schedule plan

Earned-value plan

Team roles

Task plans

Detailed plans

Quality plan

Risk evaluation

Risk mitigation plans

Alternate plans

Topics

How does TSP work?

TSP Data

TSP and CMMI

TSP Results

The TSP Base Measures

You can't manage what you can't measure.

To help teams know where they stand, every TSP project gathers and uses four base measures.

Status reports are generated from these data.

Size, effort, and defects are measured exactly the same way as in the PSP.

Size

Effort

Defects

Schedule

What the TSP Base Measures Provide

Sample of Derived Measures

Estimation accuracy (size and time)

Prediction intervals (size and time)

Time in phase distribution

Defect injection phase distribution

Defect removal phase distribution

Productivity

%Reuse

%New Reusable

Cost performance index

Planned value

Earned value

Predicted earned value

Derived Measures (continued)

Defect density

Defect density by phase

Defect removal rate by phase

Defect removal leverage

Review rates

Process yield

Phase yield

Failure cost of quality

Appraisal cost of quality

Appraisal/Failure COQ ratio

Percent defect free

Defect removal profiles

Quality profile

Quality profile index

The Overall Plan with Estimates and Planned Dates

	A	B	C	K	L	M	N	O	P	Q	R	S	T
1	**TSP Task Planning Template - Form TASK**										Total Plan Hours		
2	**Name** Tops Down for the Widget Project										953.2		
3	**Team** Wizards						Reminder:						
4	**Date** 8/18/2004						If Size and Rate are present, estimated hours is calculated as Size / Rate						
5							whenever the plan is updated. To prevent calculation, size or rate must be blank.						
6	**Cycle**												
7	Assembly	Phase	Task	Resources	Estimated Size	Size Measure	Rate (per Hr.)	Time in Phase %	Estimated Hours	Engrs	Plan Hours	Plan Date	Plan Week
43	"A" Software	DLDINSP	"A" SW DLDINSP - Resolve Issues						2.0	1.0	2.0	11/15/2004	14
44	"A" Software	CODE	"A" SW CODE		1000	LOC	15.0	30.0	20.0	1.0	20.0	11/15/2004	14
45	"A" Software	CR	"A" SW CR		1000	LOC	15.0	10.0	6.7	1.0	6.7	11/15/2004	14
46	"A" Software	CODEINSP	"A" SW CODEINSP - Inspection		1000	LOC	200.0		5.0	3.0	15.0	12/6/2004	17
47	"A" Software	CODEINSP	"A" SW CODEINSP- Inspection Meeting						1.0	3.0	3.0	12/6/2004	17
48	"A" Software	CODEINSP	"A" SW CODEINSP - Resolve Issues						2.0	1.0	2.0	12/6/2004	17
49	"A" Software	COMPILE	"A" SW COMPILE		1000	LOC	15.0	3.0	2.0	1.0	2.0	12/6/2004	17
50	"A" Software	UT	"A" SW UT		1000	LOC	15.0	12.0	8.0	1.0	8.0	12/6/2004	17
51												12/6/2004	17
52	"B" Software	DLD	"B" SW DLD		1600	LOC	15.0	30.0	32.0	1.0	32.0	12/13/2004	18
53	"B" Software	DLDR	"B" SW DLDR		1600	LOC	15.0	15.0	16.0	1.0	16.0	12/13/2004	18
54	"B" Software	DLDINSP	"B" SW DLDINSP - Inspection		1600	LOC	200.0		8.0	3.0	24.0	12/13/2004	18
55	"B" Software	DLDINSP	"B" SW DLDINSP - Inspection Meeting						1.0	3.0	3.0	12/13/2004	18
56	"B" Software	DLDINSP	"B" SW DLDINSP - Resolve Issues						2.0	1.0	2.0	12/13/2004	18
57	"B" Software	CODE	"B" SW CODE		1600	LOC	15.0	30.0	32.0	1.0	32.0	1/3/2005	21
58	"B" Software	CR	"B" SW CR		1600	LOC	15.0	10.0	10.7	1.0	10.7	1/3/2005	21
59	"B" Software	CODEINSP	"B" SW CODEINSP - Inspection		1600	LOC	200.0		8.0	3.0	24.0	1/3/2005	21
60	"B" Software	CODEINSP	"B" SW CODEINSP- Inspection Meeting						1.0	3.0	3.0	1/3/2005	21
61	"B" Software	CODEINSP	"B" SW CODEINSP - Resolve Issues						2.0	1.0	2.0	1/3/2005	21
62	"B" Software	COMPILE	"B" SW COMPILE		1600	LOC	15.0	3.0	3.2	1.0	3.2	1/10/2005	22
63	"B" Software	UT	"B" SW UT		1600	LOC	15.0	12.0	12.8	1.0	12.8	1/10/2005	22
64													

Buttons: Generate Task List | Update Task and Schedule Plan

Sheet tabs: TSP Instructions / PlanGuide / QualGuide / Project / Team / Goals / Roles / SUMP / SUMQ / SUMS \ **Task** / Schedule / LOGT / LOGD / Week / IRTL / IRWeek / DefectTypes / QProfParam

The SCHEDULE worksheet

TSP Schedule Planning Template - Form SCHEDULE

	Name	Tops Down for the Widget Project							Total Task Plan Hours	953.2
	Team	Wizards							Total Schedule Plan Hours	1000.0
	Date	8/18/2004							Difference	-46.8
	Cycle									

Date	Week	Planned Hours	Cumulative Planned Hours	Actual Hours	Cumulative Actual Hours	Planned Value	Cumulative Planned Value	Earned Value	Cumulative EV	Predicted Hours Cumulative	Predicted Earned Value Cumulative	Predicted Baseline Plan	Hours Baseline	Cumulative Baseline Plan	Value Baseline Cumulative	Notes
8/16/2004	1	0.0														
8/23/2004	2	60.0														
8/30/2004	3	40.0														Memorial Day Weekend
9/6/2004	4	60.0														
9/13/2004	5	60.0														
9/20/2004	6	60.0														
9/27/2004	7	60.0														
10/4/2004	8	60.0														
10/11/2004	9	60.0														
10/18/2004	10	60.0														
10/25/2004	11	60.0														
11/1/2004	12	60.0														
11/8/2004	13	60.0														
11/15/2004	14	60.0														
11/22/2004	15	0.0														Thanksgiving week
11/29/2004	16	0.0														Relaunch - decided to do right after vacation
12/6/2004	17	60.0														
12/13/2004	18	60.0														
12/20/2004	19	0.0														Holiday Break
12/27/2004	20	0.0														Holiday Break
1/3/2005	21	60.0														
1/10/2005	22	60.0														

Quality Plan

The team completes the quality plan.

Defect Injection Rates (Defects Injected Per Hour)	Plan	Actual
Planning	0	0.00
Requirements	0.25	0.00
System Test Plan	0	0.00
REQ Inspection	0	0.00
High-Level Design	0.25	0.00
Integration Test Plan	0	0.00
HLD Inspection	0	0.00
Detailed Design	0.75	0.00
DLD Review	0	0.00
Test Development	0	0.00
DLD Inspection	0	0.00
Code	2	0.00
Code Review	0	0.00
Compile	0.3	0.00
Code Inspection	0	0.00
Unit Test	0.067	0.00
Build and Integration Test	0	0.00
System Test	0	0.00

Phase Yields	Plan	Actual
Planning	0%	0%
Requirements	0%	0%
System Test Plan	0%	0%
REQ Inspection	70%	0%
High-Level Design	0%	0%
Integration Test Plan	0%	0%
HLD Inspection	70%	0%
Detailed Design	0%	0%
DLD Review	70%	0%
Test Development	0%	0%
DLD Inspection	70%	0%
Code	0%	0%
Code Review	70%	0%
Compile	50%	0%
Code Inspection	70%	0%
Unit Test	90%	0%
Build and Integration Test	80%	0%
System Test	80%	0%
Acceptance Test	65%	0%

Planned and Predicted End Dates

The Team worksheet provides the Planned and Predicted End Date for each engineer. This is useful for review at weekly meetings to see how balanced the overall workload is.

The Predicted End Dates are calculated based on the task hours remaining, the planned schedule hours, and actual rate of earned value

ID	Name	Initials	Phone	e-mail	Workbook Filename	Planned Tasks	Planned Task Hours	Planned Schedule Weeks	Planned End Date	Predicted End Date
01	A	aa			aa	31	228.6667	19	11/22/04	12/20/04
02	B	bb			bb	26	216.6667	16	11/29/04	11/8/04
03	C	cc			cc	23	100.8333	16	11/29/04	11/1/04
04	D	dd			dd	10	97	25	11/22/04	1/31/05
05										
06										
						90	643.1667	25	11/29/04	1/31/05
							Total		Max	

Note: two engineers are predicted to finish late, while the other two are predicted to be early.

Predicted project completion

WEEK -1

TSP Week Summary - Form WEEK

Name	A
Team	Wizards
Status for Week	6
Week Date	9/20/04 SYSTEM

Date	9/27/04
Cycle	

Selected Assembly

Task Hours %Change

Baseline	205.0
Current	235.2
%Change	14.7%

Weekly Data	Plan	Actual	Plan / Actual	Plan - Actual
Schedule hours for this week	10.0	11.9	0.84	-1.9
Schedule hours this cycle to date	90.0	74.7	1.21	15.3
Earned value for this week	4.3	13.6	0.31	-9.4
Earned value this cycle to date	37.2	33.0	1.13	4.3
To-date hours for tasks completed	77.5	74.7	1.04	
To-date average hours per week	15.0	12.4	1.21	
EV per completed task hour to date	0.480	0.441		

Project End Date

Baseline	12/6/04
Plan	12/6/04
Predicted	1/10/05

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WEEK -2

Task	Resource	Task Plan Hrs.	Task Actual Hrs.	Earned or Plan Value	Plan vs. Actual Hrs.	Baseline or Committed Date	Plan Date	Slip Date	Predicted Date	Actual Date
MILESTONES										
"A" Requirements REQINSP - resolve issu	aa	5.0				12/13/04	11/1/04	11/8/04	11/15/04	
"A" SW UT	aa	8.0				2/21/04	1/10/05	1/17/05	1/31/05	
TASKS COMPLETED IN WEEK 6										
"A" SECTION B - write requirements	aa	20.0	20.7	8.5	0.96	9/13/04	9/13/04		9/20/04	9/20/04
"A" SECTION C - write requirements	aa	12.0	10.9	5.1	1.10	9/13/04	9/13/04		9/21/04	9/21/04
TASKS DUE THROUGH WEEK 8										
A Forgotten Task Added 1		10.0		4.3			9/20/04	9/27/04	10/4/04	
A Forgotten Task Added 2		10.0		4.3			9/27/04	10/4/04	10/11/04	
A Forgotten Task Added 3		10.0		4.3			10/4/04	10/11/04	10/18/04	
"A" SECTION D - write requirements	aa	14.0		6.0		9/27/04	10/18/04	10/25/04	10/25/04	

QualGuide / Project / Team / Goals / Roles / SUMP / SUMQ / SUMS / Task / Schedule / LOGT / LOGD / **Week** / IRTL / IRWeek / DefectTypes / QProfParam /
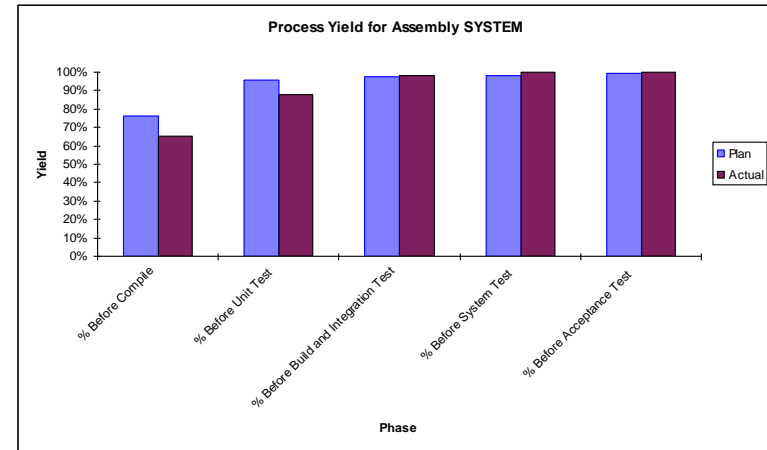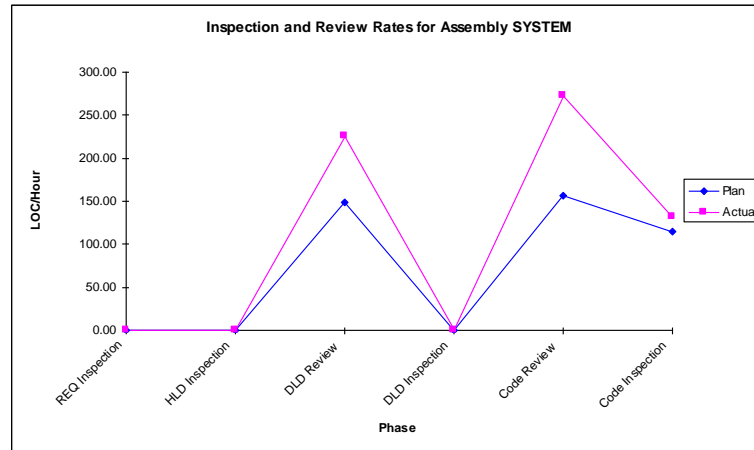
Sample of TSP Analysis Charts -1
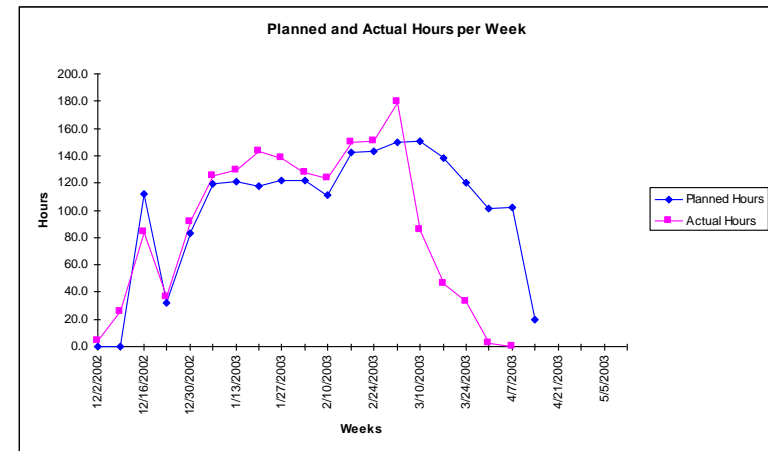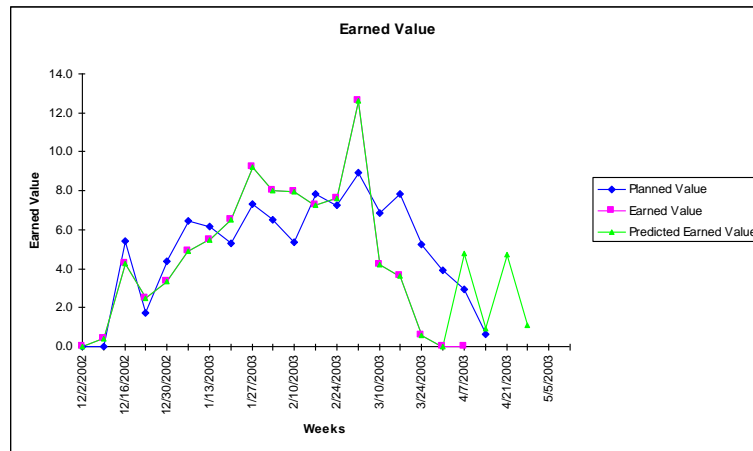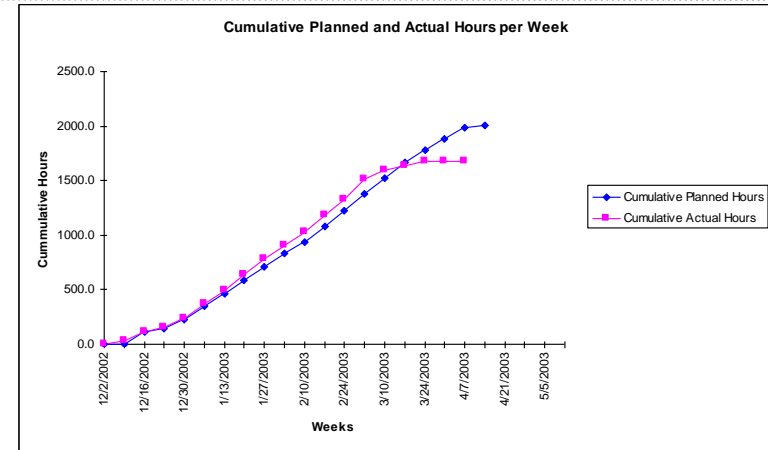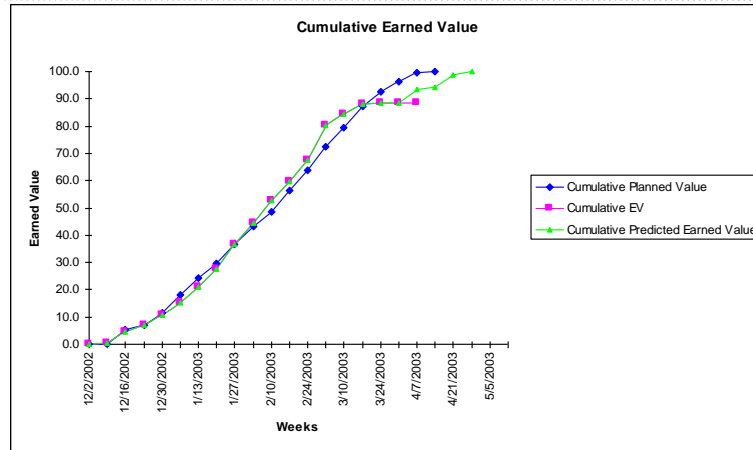
Sample of TSP Analysis Charts -2
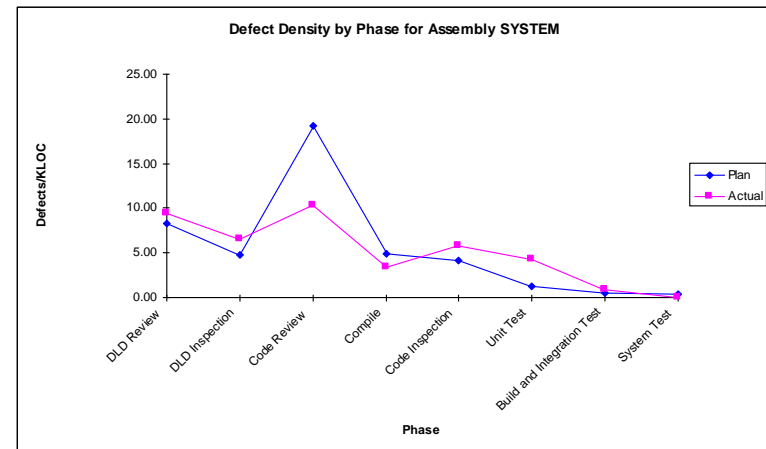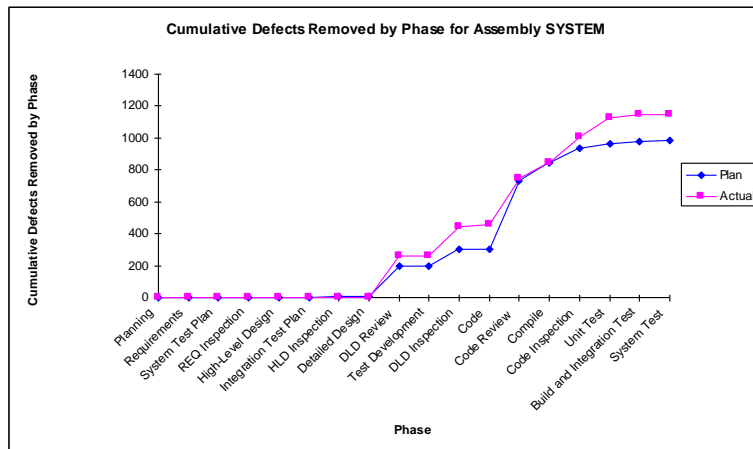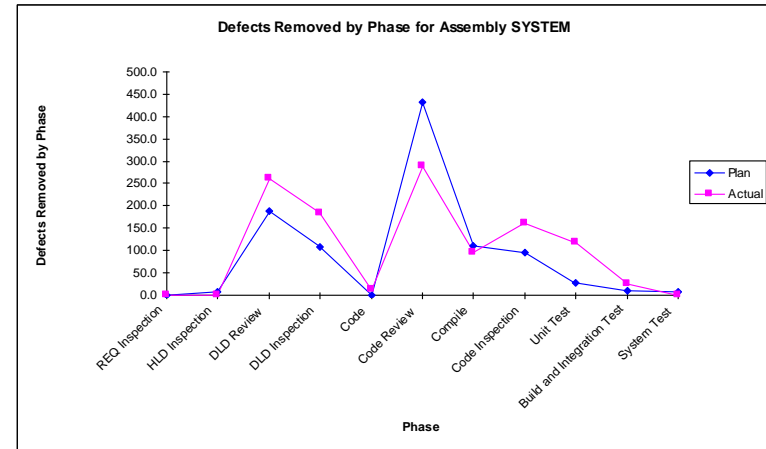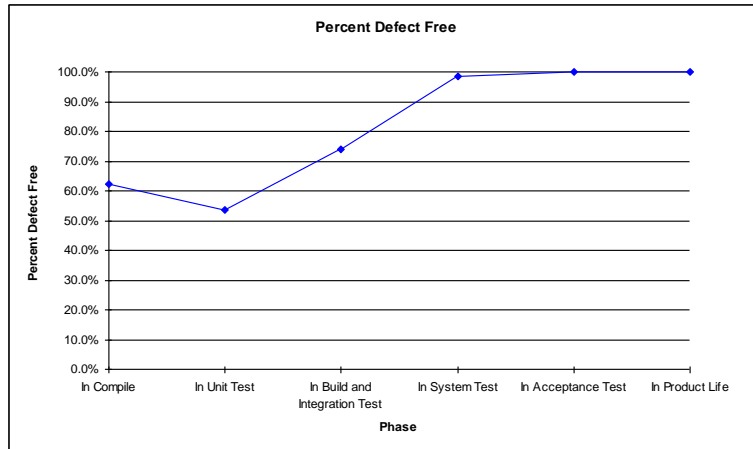
Sample of TSP Analysis Charts -3
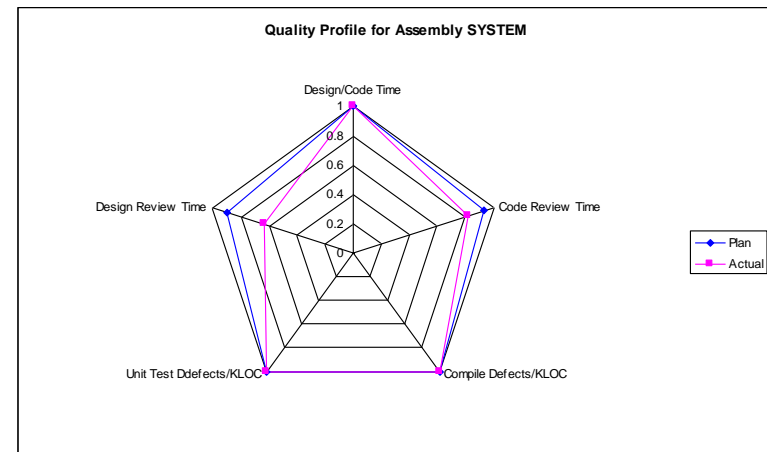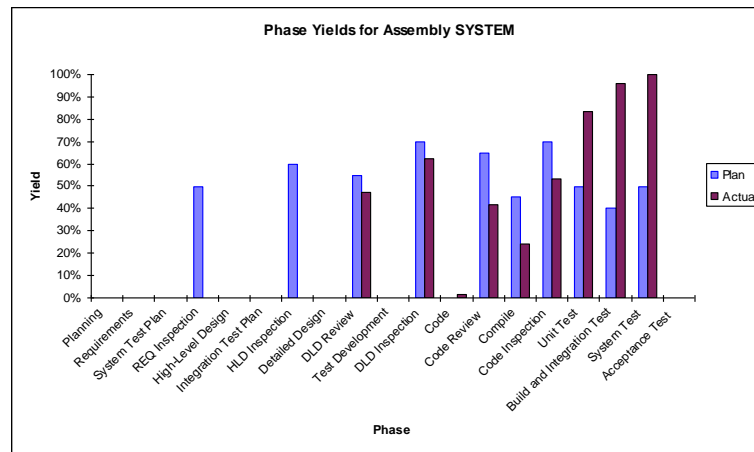
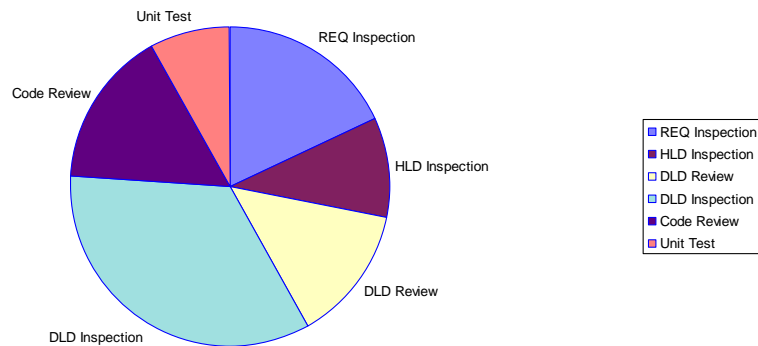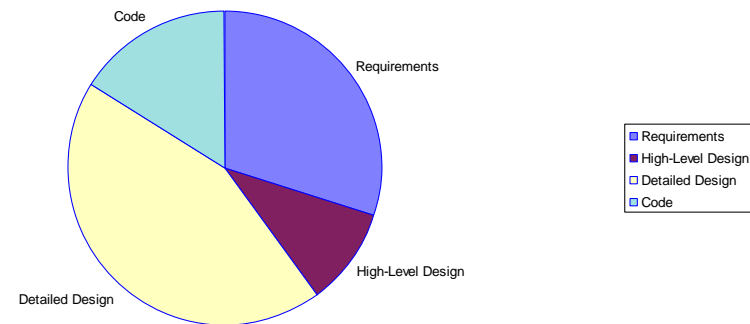# Sample of TSP Analysis Charts -4
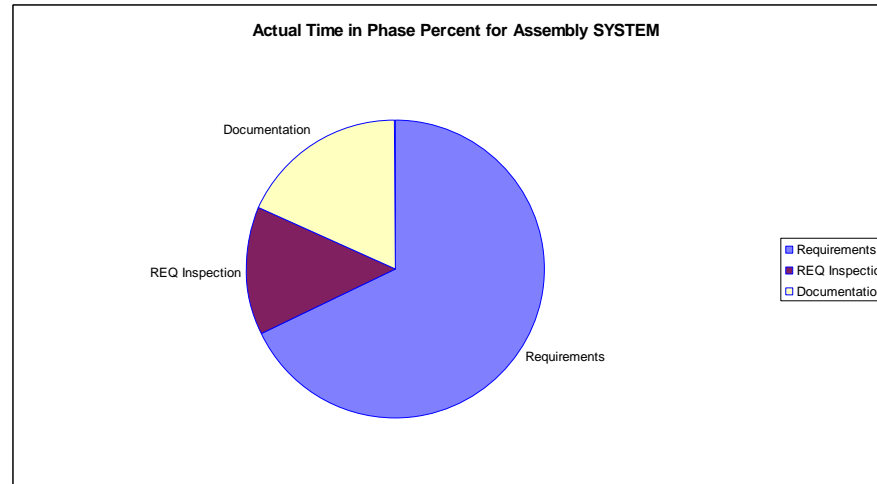
Topics

How does TSP work?

TSP Data

TSP and CMMI

TSP Results

TSP and CMMI Are Complementary

CMMI is…

- a model of best practices

- about "what" not "how-to"

- an improvement roadmap

- a capability benchmark

TSP is…

- an instance of best practices

- about "how-to" not "what"

- an improvement tool

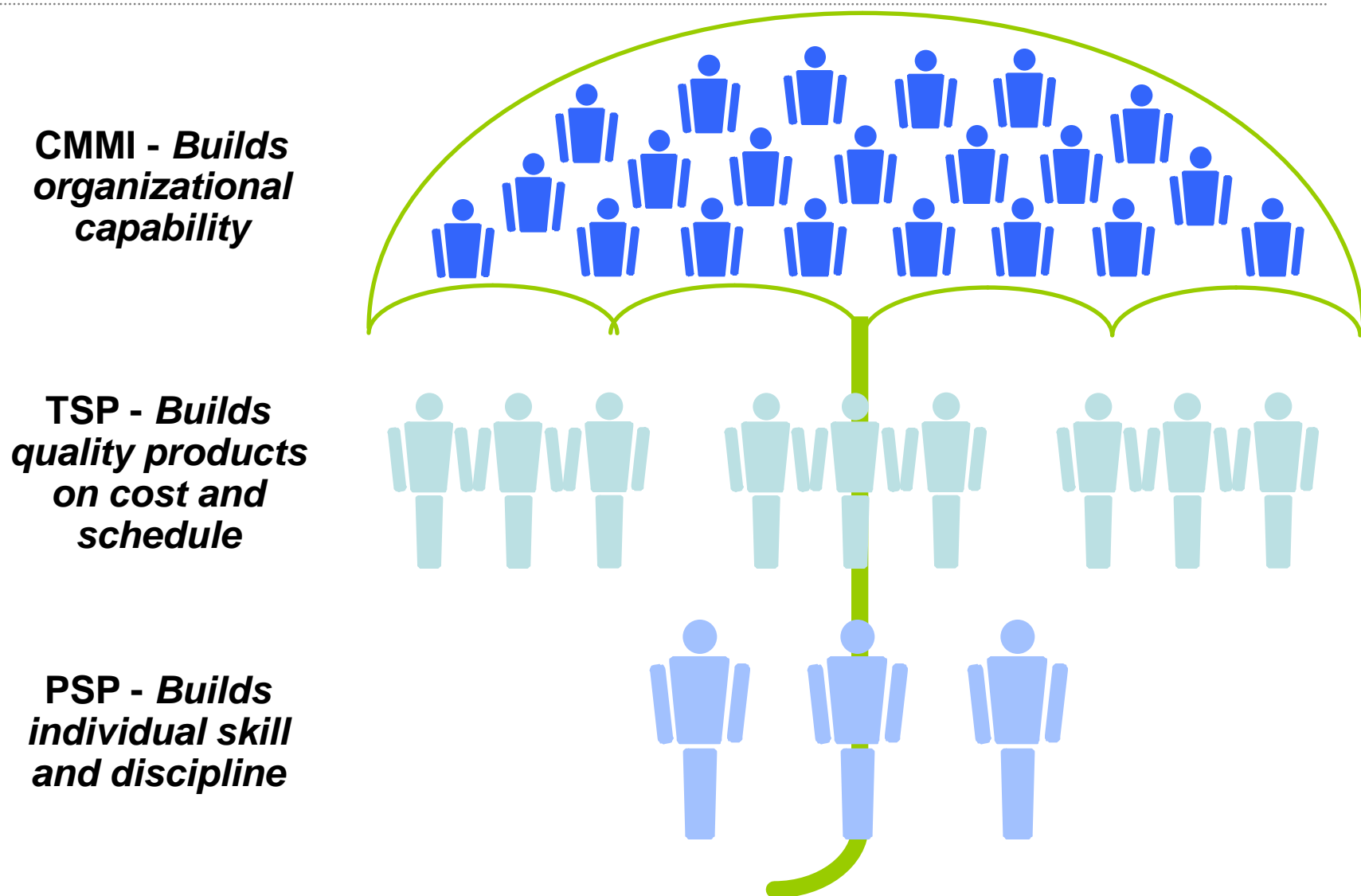- a performance benchmark

What Do CMMI and TSP Have in Common?

Five ideas from a broad array of fields provided the original foundation for the CMMI.

- Planning, tracking, cost and schedule management

- Requirements definition and configuration control

- Process assessment

- Quality management and continuous improvement

- Evolutionary improvement

All of these same ideas found their way into the TSP except process assessment.

CMMI, TSP & PSP Relationship

CMMI - *Builds organizational capability*

TSP - *Builds quality products on cost and schedule*

PSP - *Builds individual skill and discipline*

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When transitioning from a Project to a Organizational focus

TSP can provide an organization with a common vocabulary to start with in terms of how work should be performed

TSP will define many of the day-to-day processes, which allows teams to focus on communication and the technical challenges before them

TSP provide a common data definitions and collection method to address organizational data needs.

Accelerated Process Improvement

TSP addresses or supports most of the capabilities expected of a project team through CMMI Level 5.

It provides a "starting point" for low-maturity organizations.

It provides a "next step" for high-maturity organizations.
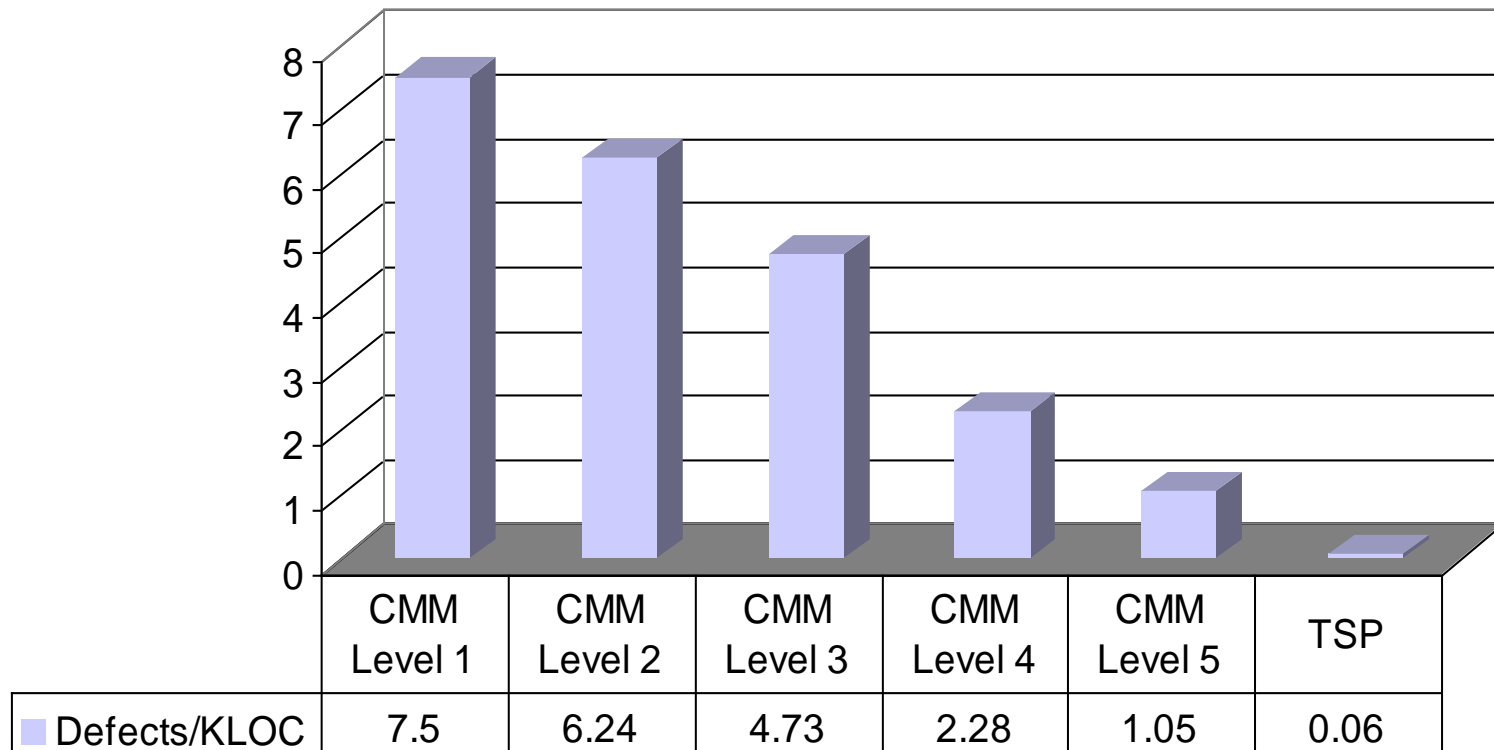
Three organizations have used TSP to advance from ML1 to ML4 in only 2.5 years.
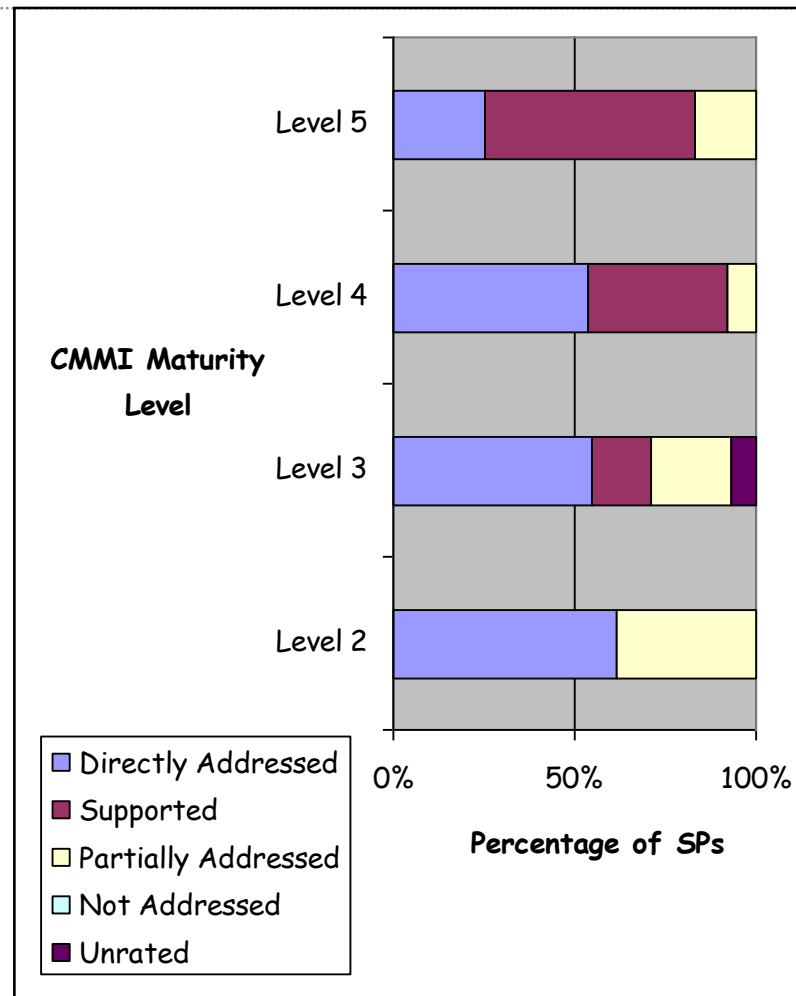
Source: Mapping TSP to CMMI, CMU/SEI-2004-TR-014

CMMI and TSP Quality Performance

Average Defect Density of Delivered Software

	CMM Level 1	CMM Level 2	CMM Level 3	CMM Level 4	CMM Level 5	TSP
▨ Defects/KLOC	7.5	6.24	4.73	2.28	1.05	0.06

Source: CMU/SEI-TR-2003-014

Level 5 and Continuous Improvement

	Project A (TSP)	Project B
Size (KLOC)	82	151
Duration (months)	31.8	43.0
Normalized (per KLOC)	$0.95K	$4.05K
Peer Review Exit Density	4.78	17.3
Delivered Defect Density	1.55	5.27
Integration / Acceptance Test Cost	$78.K	$612K
Time to Accept (months)	3.7	14.6

Source: Northrop Grumman IT (a CMMI Level 5 organization)

http://www.dtic.mil/ndia/2003CMMI/kent.ppt

TSP Advantages

Unlike most other engineering methods or processes, TSP

- leads to positive change in the behavior of individuals, teams, and the organization through an embedded change management strategy.

- improves performance, with quantifiable benefits, on first use.

- uses a project-by-project introduction strategy that pays for itself.

- is a disciplined and agile approach to engineering.

- has been applied to a broad range of application domains and is scalable from very small to large projects and teams.

- is adapted to existing processes and methods rather than replacing them.

Topics

How does TSP work?

TSP Data

TSP and CMMI

TSP Results

NAVAIR Benefits from TSP

Program	Size of Program	Defect Density (Defects/KSLOC))	Cost Savings from Reduced Defects
AV JMPS	443 KSLOC	0.59	$2,177,169
P-3C	383 KSLOC	0.6	$1,478,243

Program	Schedule Variance	Cost Variance
AVJMPS	0.5% overrun	1.5% overrun
H2.0	1.1% overrun	6.9% overrun

Quality Benefits

TSP dramatically reduces the effort and schedule for system test.

Most defects are removed during reviews and inspections at a cost of 2 to 25 minutes per defect.

System test removal costs run from to 2 to 20 hours per defect.
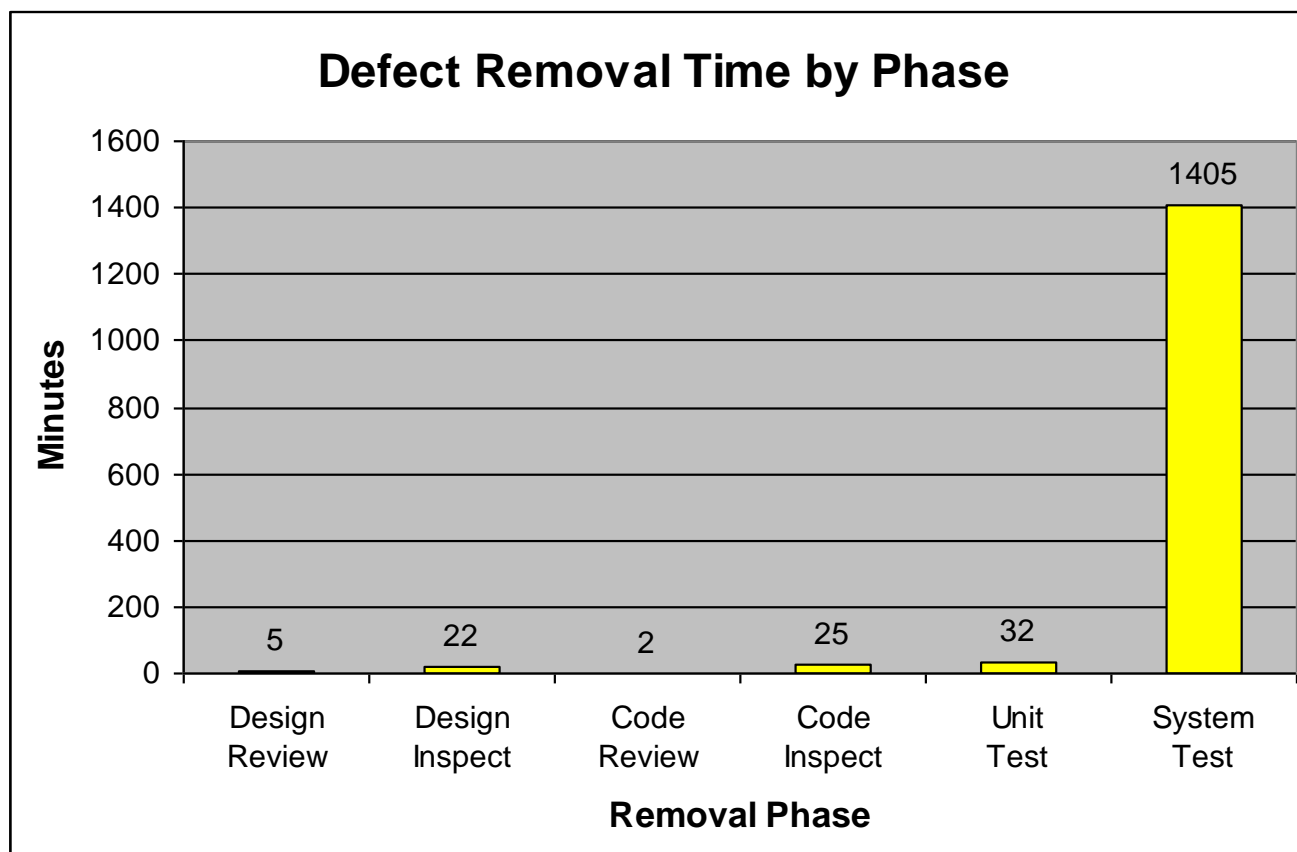
These benefits continue after delivery.

- lower support costs

- satisfied customer

- better resource utilization

TSP System Test Performance Comparison w/Table

	System Test % of Effort	System Test % of Schedule	Failure COQ
☐ TSP Min.	2%	8%	4%
☐ TSP Avg.	4%	18%	17%
■ TSP Max.	7%	25%	28%
☐ Typical Projects	40%	40%	50%

Source: CMU/SEI-TR-2003-014
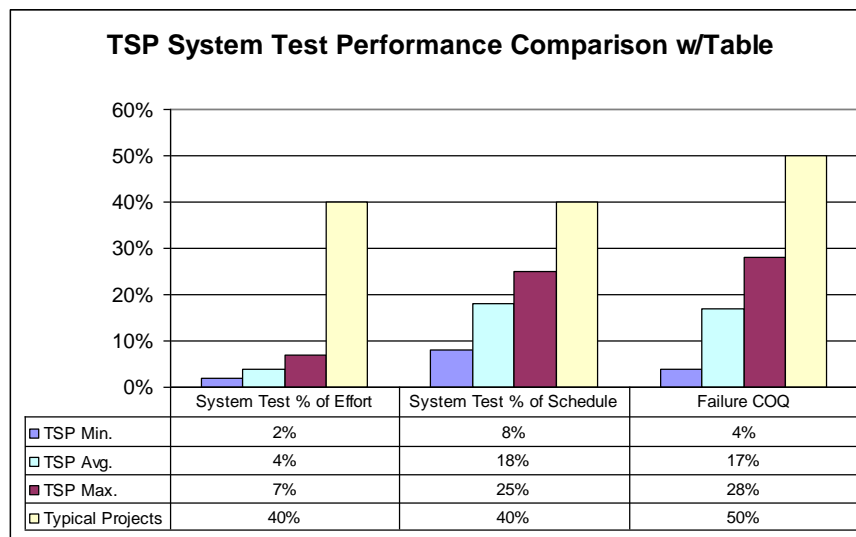
Reviews and Inspections Save Time

Xerox found that TSP quality management practices reduced the cost of poor quality by finding and removing defects earlier when costs are lower.
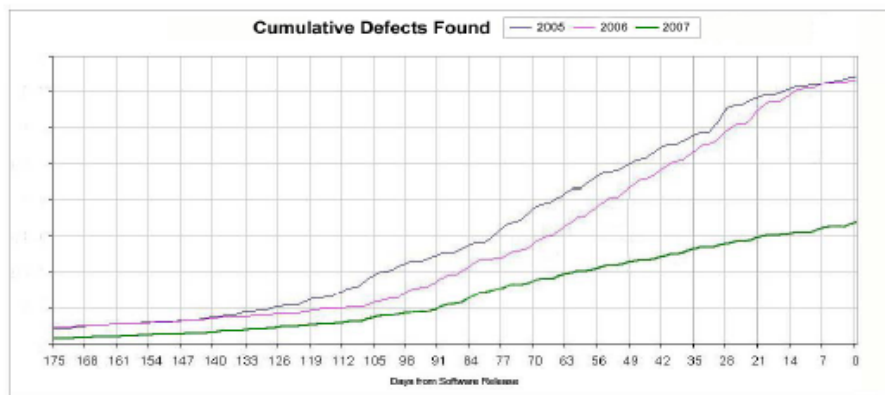
Defect Removal Time by Phase

Removal Phase	Minutes
Design Review	5
Design Inspect	22
Code Review	2
Code Inspect	25
Unit Test	32
System Test	1405

Source: Xerox

Intuit Quality Improvement

TSP reduced defects found in system test by 60% over the previous two releases of QuickBooks 2007 release.

Intuit has also recently reported a savings of $20M from a reduction in customer support calls on QuickBooks 2007.

Results at Intuit: Improved Quality

Cumulative Defects Found — 2005 — 2006 — 2007

175 168 161 154 147 140 133 126 119 112 105 98 91 84 77 70 63 56 49 42 35 28 21 14 7 0

Days from Software Release

In 2007 ~60% fewer defects were found in System Test than the previous two releases

Source: Intuit

Intuit Productivity Improvement

By putting a quality product into system test Intuit improved productivity and reduced cost while delivering 33% more functionality than planned.

Results at Intuit: Productivity

- During 2007 over 60% of Intuit's Small Business Division used TSP
- TSP was a major contributor to the QuickBooks 2007 release
- It was the smoothest release anyone can remember:
  - On time delivery of all planned scope
  - 13 new features were added during the cycle(33% of initial scope)
  - Saved $700K in temporary testing staff expenses
  - Level of automated testing coverage was doubled compared to previous year

Focused improvements helped deliver a great release

Source: Intuit

Improving Task Hours

At Allied Signal average task hours per developer per week were improved from 9.6 hours to 15.1 hours through quiet time, process documentation, more efficient meetings, etc.

This is equivalent to a 57% increase in productivity.

If you didn't have such detailed information, would you even know that you had a problem? Or an opportunity for such dramatic improvement?
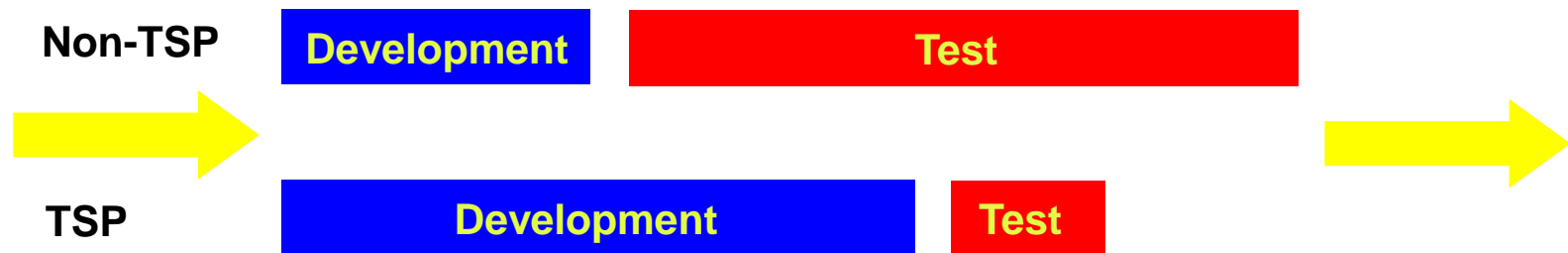

Actual Task Hours per Week
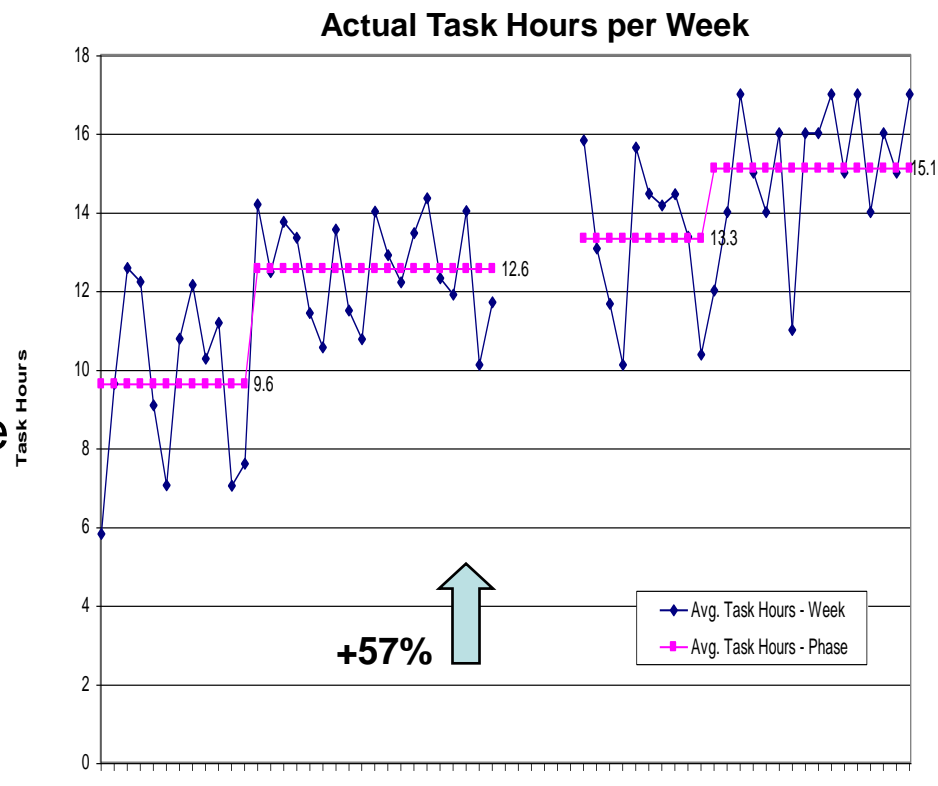
Source: Allied Signal

Intuit Test Schedule Reduction

From data on over 40 TSP teams, Intuit has found that

- post code-complete effort is 8% instead of 33% of the project

- testing time is reduced from four months to one month

Source: Intuit

Microsoft Schedule Improvement

First-time TSP projects at Microsoft had a 10 times better mean schedule error than non-TSP projects at Microsoft as reflected in the following table.

Microsoft Schedule Results	Non-TSP Projects	TSP Projects
Released on Time	42%	66%
Average Days Late	25	6
Mean Schedule Error	10%	1%
Sample Size	80	15

Source: Microsoft

Work-Life Balance

People are your most important resource.

Finding and retaining good people is critical to long-term success.

Intuit found that TSP improved work-life balance, a key factor in job satisfaction


Results at Intuit: Improved Work-Life Balance

- Half as many weekend source check-ins (<3%)

- Reduced $ on dinners as measured by PSS – "Pizza Slices Served"

12,000 pizza slices served last year

vs

~30 pizza slices this year

TSP helped improved employee work life balance
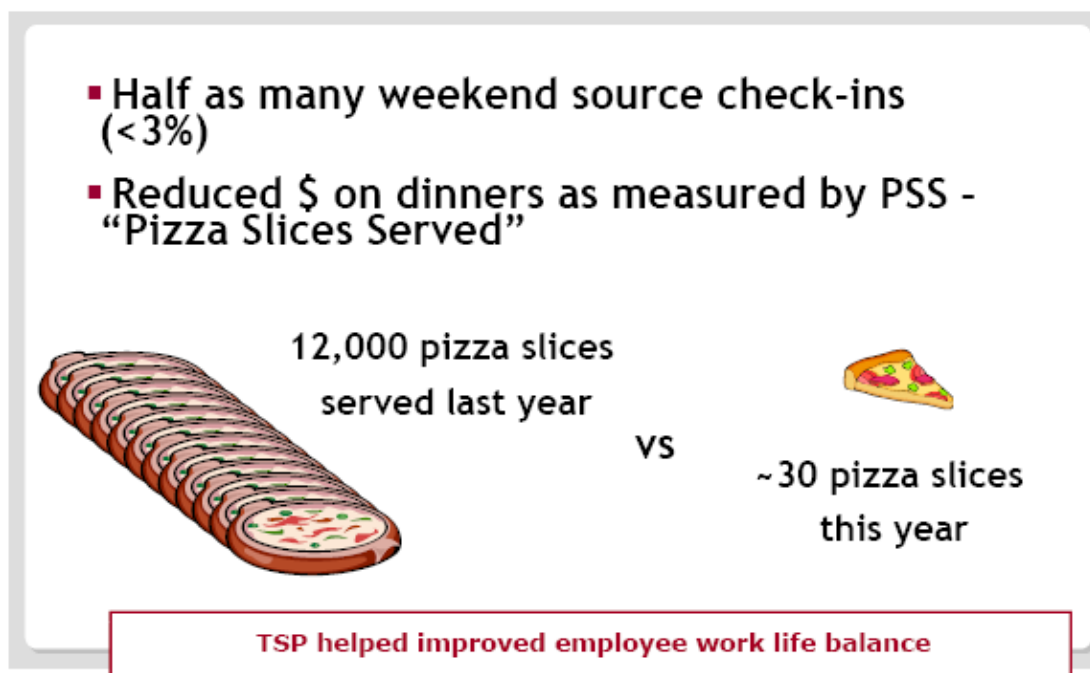
Source: Intuit

Intuit TSP Survey Results

Improved work-life balance with TSP is reflected in job satisfaction surveys.
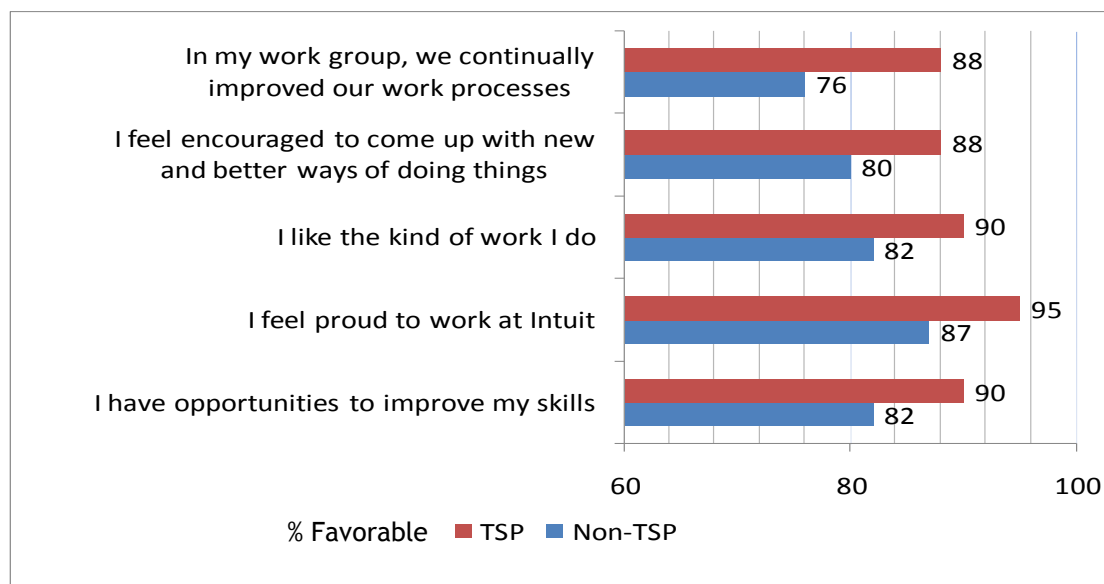
"Engineers love it... Once they adopt it they can't imagine going back"

Source: Intuit

Questions?

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PSP/TSP website:
http://www.sei.cmu.edu/tsp

Topics

What is PSP and TSP

Type of data you get from a TSP Tool

TSP and CMMI

TSP Results

The people side of change ⬅

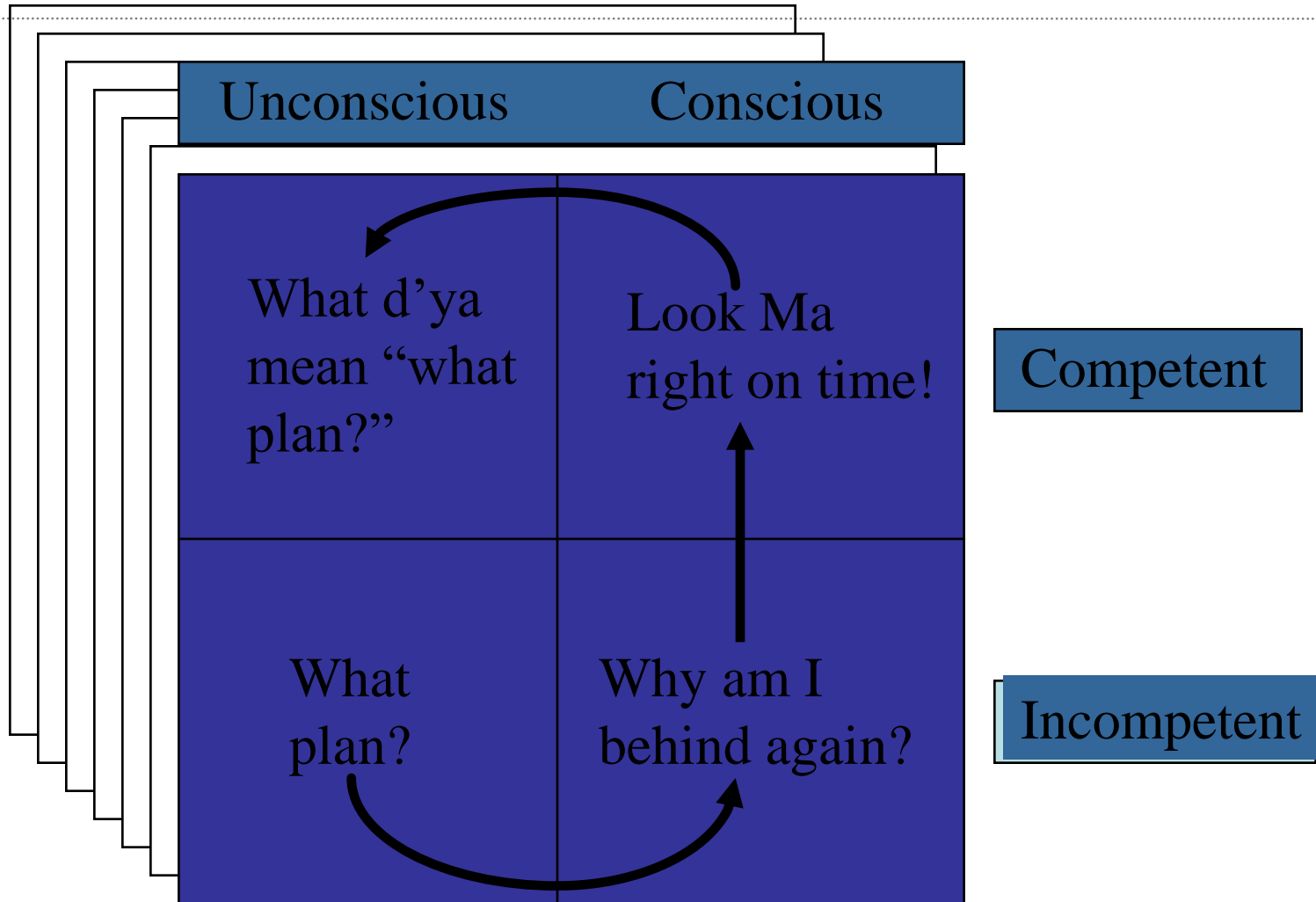TSP and the people side of change

The learning stages

Adapted from Hayes, 1993

Normal Transition Scenarios

Self confidence

High

Hey, my AFR reached 2.3!!!

Gee, all those forms!

I'll watch TV instead

Low
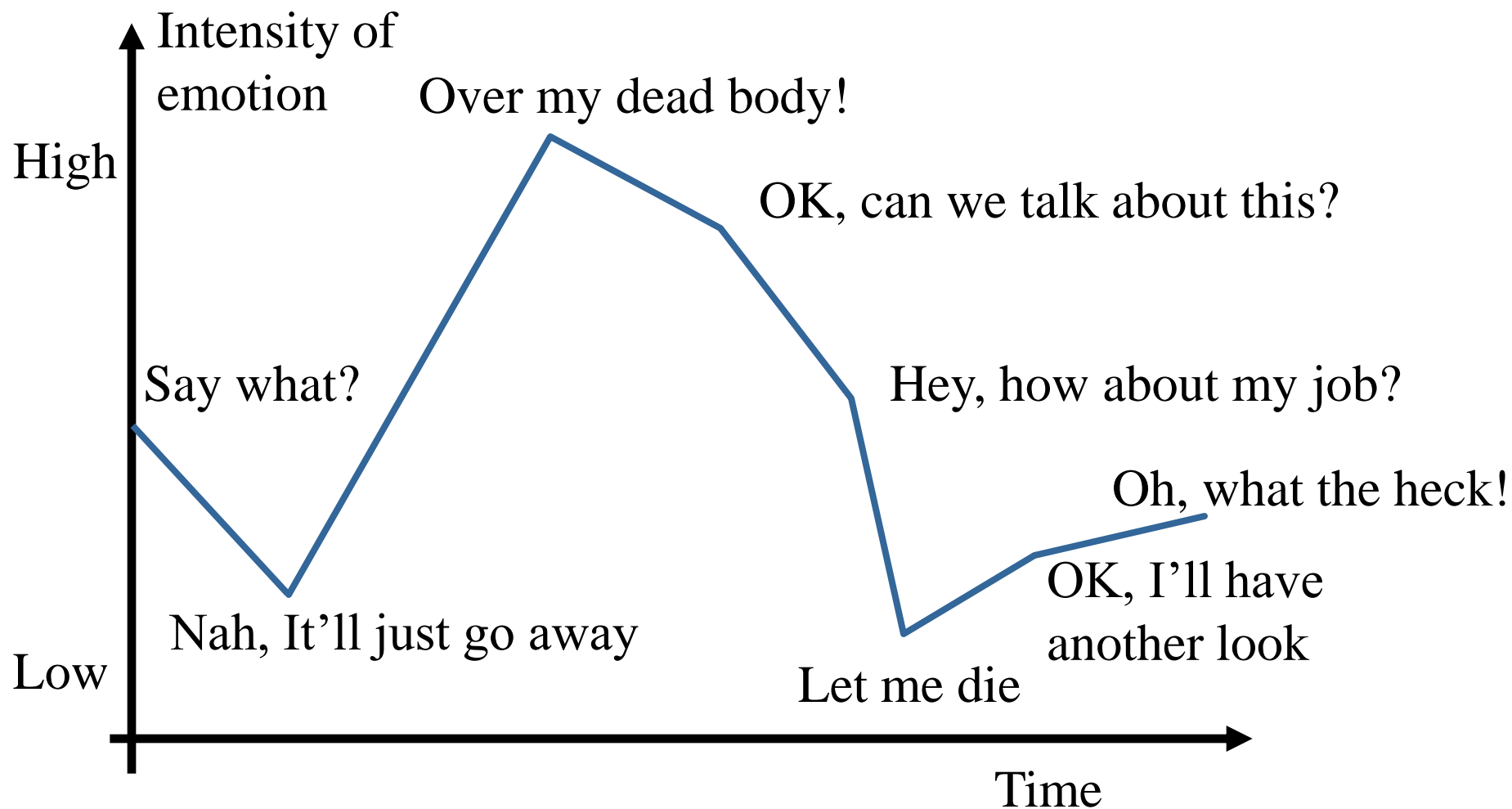
Time
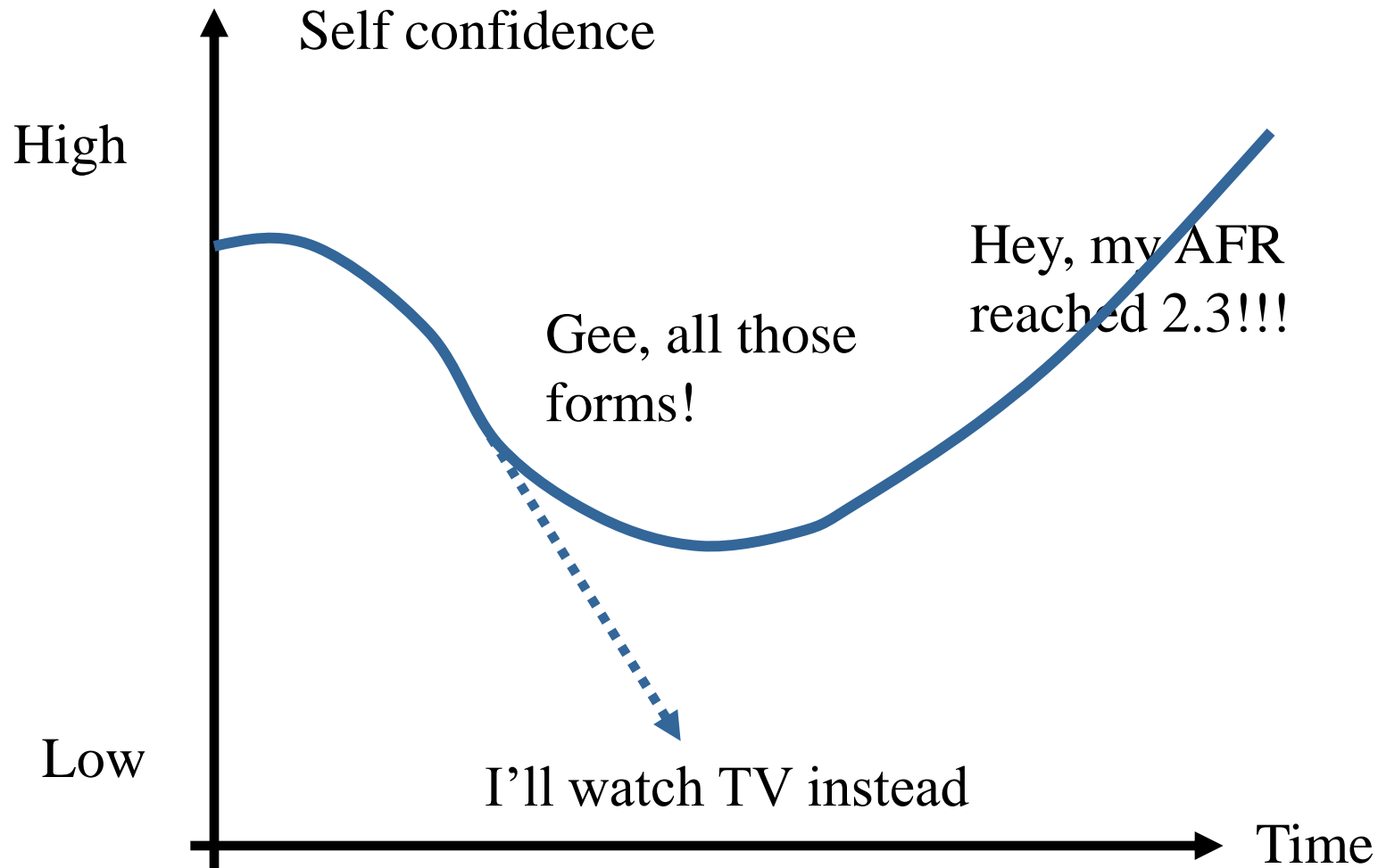
Adapted from IMA, 1989

Material obtained from Software Technology, Process & People (STPP)

Reaction to change

Adapted from IMA, 1989

Material obtained from Software Technology, Process & People (STPP)

Managing Change

- Create **awareness** of why the change is happening

- Build **desire** to support and participate in the change

- Provide the **knowledge** needed to change

- Demonstrate **ability** to implement new skills and behaviors

- Provide **reinforcing** environment to sustain the change

What are the potential impacts of not managing change?

Managers may be unwilling to assign adequate **resources** to support the change.

Managers may create **negative messages** about the change to their peers and subordinates.

Employees may **lose interest** in their work resulting in productivity losses and negative impacts with customers.

Employees may **leave** the organization

Unforeseen **obstacles** to the change seemingly appear from nowhere.

Funding is not made available to implement or sustain the change.

A sudden shift in **priorities** is observed with less emphasis on the current change.

Topics

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TSP and the people side of change

Deploying TSP -1

Sprinkling a few TSP/PSP-trained engineers around an organization will not produce noticeable results.

Installing TSP in an organization requires

- a team-based improvement focus

- careful planning

- senior management involvement and sponsorship

Deploying TSP -2

- TSP is introduced into an organization on a project-by-project or team-by-team basis.

- TSP is more than a training program, the new skills must be used in a team setting soon after training ends.

- Treat the deployment like a project.

  – Set goals

  – Assign responsibilities

  – Allocate resources

  – Involve line management

  – Plan and track

TSP Introduction Steps	
1.	Start by identifying external or internal resources to lead the effort.
2.	If internal resources are selected, send them to SEI training to become authorized instructors and coaches.
3.	Train top management, then select two or three initial projects or teams.
4.	Train the selected teams and their managers then launch the teams.
5.	Monitor the projects and make adjustments as needed.
6.	Expand the scope, selecting additional projects or teams.
7.	Create or expand the pool of available SEI-authorized instructors and/or coaches.
8.	Repeat starting at step 4.

Training Participants

Participant	Course	Notes
Executives and senior management	*TSP Executive Strategy Seminar*	1 day + optional ½ day strategic planning session.
Middle and first-line managers	*Leading Development Teams*	3 days
Software developers	*PSP Fundamentals*	5 days
	PSP Advanced	5 days (optional)
	PSP I	5 days
	PSP II	5 days
	(Alternative to *PSP Fundamentals* and *Advanced)*	
Other team members	*Introduction to Personal Process*	2.5 days
	TSP Team Member Training	2.5 days
	(Alternative to Introduction to Personal Process)	
Instructors	*PSP Instructor Training*	5 days Pre-requisite training: *PSP Fundamentals and PSP Advanced or PSP I and PSP II*
Coaches	*TSP Coach Training*	5 days Pre-requisite training: *PSP Fundamentals and PSP Advanced or PSP I and PSP II*

Scale-Up Approach

The broader TSP introduction should repeat the pilot project steps across the organization.

- Define each location's goals and responsibilities.

- Work project by project.

- Build an experience base.

- Train managers and executives first.

- Train developers.

- Launch projects with TSP.

Treat each new introduction as a test.

- Use TSP methods.

- Gather data.

- Evaluate results.

- Adjust plans and methods as needed.

The Scale-Up Team

Form a scale-up leadership team.

- TSP trained

- All required skills, disciplines, and constituencies

- A core of full-time members

Conduct a TSP launch of the scale-up effort.

- All team members present

- Management participate in opening and closing meetings

- Monitor and review like an engineering project

Sustaining the TSP - 1

To sustain long-term TSP transition, incorporate the TSP transition goals into the organization's business system.

- Reward and recognition programs

- Salary and promotion reviews

- Career planning

- Bonus criteria

- High-potential management programs

When TSP success is recognized as a ticket to personal advancement, sustained improvement will be assured.

Sustaining the TSP - 2

As with any disciplined activity, the TSP needs continuing reinforcement from management.

Establish regular quarterly management reviews.

- Review project performance.

- Examine key process measures.

- Establish and review benchmark comparisons.

Identify, recognize, and reward superior individual, team, and management work.

Maintain Continuing Oversight

While goals, responsibilities, and resources are essential, they are not enough to sustain a major behavior change.

If senior management appears to lose interest in the TSP transition effort

- progress will be slow

- the effort will not succeed

If you take all of these steps and show continuing interest, TSP transition will be rapid and effective.